



RIC 2013
Recent Operating Reactors Materials Issues
Quad Cities Unit 2 Instrument Nozzle Leakage

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Purpose

Provide NRC staff perspective on leakage of an instrument nozzle in a boiling water reactor pressure vessel, a first-of-a kind event.

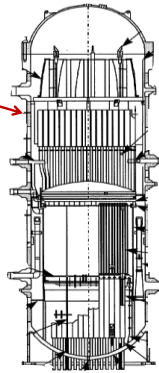
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Leaking Instrument
Nozzle Location

**Boiling Water
Reactor Pressure
Vessel**



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**Typical J-Groove
Welded Instrument
Nozzle**

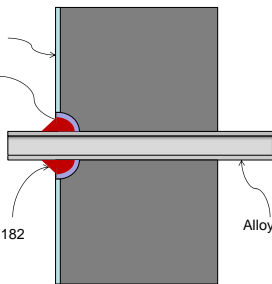
Stainless steel clad

Alloy 182

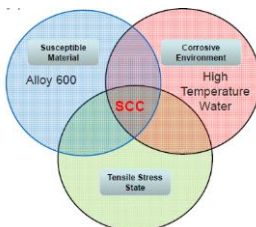
Alloy 182

Alloy 600

Low alloy
steel



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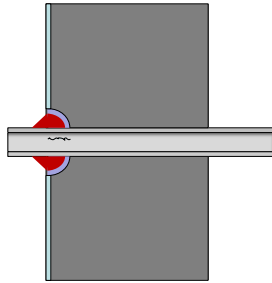
Stress Corrosion Cracking

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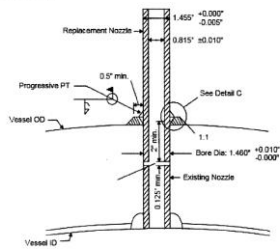


Location of Cracks (Typical)

Residual stresses from welding can lead to Primary Water Stress Corrosion Cracking (PWSCC)



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Proposed Repair – “Half Nozzle” Design

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Significance

- Stress corrosion cracking of this type of nozzle not previously observed in boiling water reactors
- Licensee evaluations demonstrated no safety issue from not removing flaw
- Root cause not proven because NRC staff granted relief from inspection to locate or size the flaw
- NRC staff and licensees should be sensitive to the need to prevent instrument nozzle leaks in boiling water reactors as plants age

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Conclusions

- NRC Staff will continue to monitor operating experience related to leakage of J-groove welded nozzles in BWRs
- NRC does not find management of aging via leak detection acceptable
- BWR licensees should consider enhanced inspections or proactive mitigation/repair of instrument nozzles